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1742

PATENT
Attorney Docket No. 401502

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:

ARAKI et al.

Application No. 10/006,679

Filed: December 10, 2001

For: THIN FILM MAGNET

Art Unit: 1742

Examiner: J. Sheehan

TRANSMITTAL OF
APPELLANTS' APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In accordance with 37 CFR 1.192, appellants hereby submit Appellants' Brief on Appeal in triplicate.

The items checked below are appropriate:

1. Status of Appellants

This application is on behalf of ☒ other than a small entity or ☐ a small entity.

2. Fee for Filing Brief on Appeal

Pursuant to 37 CFR 1.17(c), the fee for filing the Brief on Appeal is for: ☒ other than a small entity or ☐ a small entity.

Brief Fee Due $330.00

3. Oral Hearing

☐ Appellants request an oral hearing in accordance with 37 CFR 1.194.

4. Extension of Time

☐ Appellants petition for a one-month extension of time under 37 CFR 1.136, the fee for which is $110.00.

☒ Appellants believe that no extension of time is required. However, this conditional petition is being made to provide for the possibility that appellants have inadvertently overlooked the need for a petition and fee for extension of time.

Extension fee due with this request: $

5. Total Fee Due

The total fee due is:

Brief on Appeal Fee	$330.00
Request for Oral Hearing	$ 0.00
Extension Fee (if any)	$

Total Fee Due: $330.00

6. Fee Payment

☐ Attached is a check in the sum of $.
☒ Charge Account No. 12-1216 the sum of $330.00. A duplicate of this transmittal is attached.

7. Fee Deficiency.

☒ If any additional fee is required in connection with this communication, charge Account No. 12-1216. A duplicate copy of this transmittal is attached.

Respectfully submitted,

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Date: April 1, 2004
JAW:ves

PATENT
Attorney Docket No. 401502/SOGA

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:

ARAKI et al.

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APPELLANTS' APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Further to the Notice of Appeal filed February 4, 2004, Appellants now submit their Appeal Brief.

Real Party In Interest

The patent application that is the subject of this appeal is assigned to Mitsubishi Denki Kabushiki Kaisha.

Related Appeals and Interferences

There are no appeals or interferences that will be affected by or that will affect the decision in this Appeal.

Status of Claims

As filed, the application included three claims. Pursuant to a restriction requirement and election, claims 1 and 2 were elected and claim 3 was withdrawn from consideration. Claim 3 was ultimately cancelled, leaving claims 1 and 2 pending. Neither claim is allowed. The final rejection of both claims is appealed and claims 1 and 2 appear in the appendix.

Status of Amendments

In response to the final rejection mailed August 12, 2003, Applicants requested reconsideration and cancelled non-elected claim 3 but did not seek to amend either of claims 1 and 2. According to the Advisory Action mailed January 14, 2004, the Request for Reconsideration was considered but did not place the application in form for allowance. The Request for Reconsideration was entered in the record for purposes of appeal.

Summary of Invention

The invention concerns a thin film magnet having a particular structure. The structure is produced by the way in which the thin film magnet is made. Prior art thin film magnets having similar, but significantly different, microstructures, are known. The prior art thin film magnets do not and cannot have the structure of the claimed thin magnet because the prior art magnets are not made in the same way that the novel thin film magnet claimed here is made.

The claimed thin film magnet has a microstructure that includes monocrystalline phases that have the same crystalline structure as $Nd_2Fe_{14}B$. This known crystalline structure has a c-axis which, in the claimed thin film magnet, is oriented in the same direction as the thickness of the thin film magnet. In addition to the monocrystalline phases, the thin film magnet also includes an amorphous phase. Each of the monocrystalline phases is isolated from other monocrystalline phases by the amorphous phase. The claimed thin film magnet is formed by forming an $R_xM_{1-x-y}B_y$ thin film on a substrate. R is at least one of Nd, Pr, Tb, Ho, and Dy, and M is at least one of Fe, Co, and Ni. In this thin film, $0.11 \leq x \leq 0.15$, and $0.12 \leq y \leq 0.20$. This film is formed on the front surface of a substrate by a physical deposition method while controlling the temperature of the front side of the substrate within a range of $\pm$ 2°C.

Figure 2 is a cross-sectional view showing the microstructure of a thin film magnet according to the present invention. The thin film magnet is disposed on the front side of the substrate 1. This thin film magnet includes monocrystalline phases 2 separated by an amorphous phase 3. By contrast, the microstructure of a conventional thin film magnet is shown in a similar view in Figure 1. That magnet includes a number of crystalline phases, i.e., grains, that adjoin each other and cause stresses in the respective grains. There is no particular orientation of the c-axes of the grains and no amorphous phase. Figure 3 of the patent application shows the microstructure of another known thin film magnet. That microstructure includes an aggregation of monocrystalline phases separated by an amorphous phase. The

monocrystalline phases are aggregated because the respective monocrystalline phases 2 have multiple grains separated by the amorphous phase 3. In other words, numerous monocrystalline phases are in direct contact with each other and are not mutually separated by an amorphous phase as in the invention.

Figures 1-3 of the patent application are drawings made from photographs of transmission electron microscope images. Figures 19 and 20 are examples of such photographs showing portions of microstructures. Figures 3 and 2 were respectively prepared from images of the type shown in those Figures 19 and 20.

In a thin film magnet according to the invention in which the monocrystalline phases are respectively isolated by an amorphous phase, mutual interference of the monocrystalline phases during deposition of the thin film magnet is avoided. Moreover, the more orderly microstructure of the claimed thin film magnet provides improvements in the residual magnetization as compared to the magnets having the structures illustrated in Figures 1 and 3, for example. The inventors have determined that the claimed thin film magnet can only be produced when the temperature of the surface of the substrate upon which the thin film magnet is being deposited is maintained essentially constant, i.e., within a very narrow temperature range. When the temperature range is wider, then previously known structures, like those in Figures 1 and 3, are produced. Thus, the microstructure of the thin film magnet according to the invention is different from the known structures due to its method of production.

Issue

Are either of claims 1 and 2 obvious over Araki et al. (U.S. Patent 5,676,998, hereinafter Araki) considered by itself?

Grouping of Claims

Claims 1 and 2 stand or fall together.

Argument

Araki cannot suggest the invention as defined by claim 1 because Araki only describes making thin film magnet structures like those shown in Figures 1 and 3 of the patent application. Araki does not disclose or suggest either the microstructure of the claimed thin film magnet or the criticality of the method of making the claimed thin film

magnet, the method that produces the orderly microstructure of the claimed thin film magnet. That microstructure differentiates the claimed thin film magnet from the prior art.

This patent application and Araki are commonly assigned. In fact, Mr. Araki is the first-named inventor of this patent application and of the reference. Therefore, he is thoroughly familiar with the prior art applied by the Examiner as well as the difference between the claimed invention and the prior art. The application itself, reporting the differences between the invention and the prior art in numerous experimental examples, is supported by the original inventors' Declaration, and essentially functions as a presentation pursuant to 37 CFR 1.132. That presentation clearly demonstrates the difference between the invention and the prior art as to process and results, process criticality, and the superiority of the invention over the prior art. As already noted, the patent application itself differentiates between the prior art and the invention through the schematic Figures 3 and 2 and the corresponding photographs of Figures 19 and 20. These photographs, as described in the patent application at pages 6 and 18, are high-resolution transmission electron microscope images. Figure 13 is an additional schematic drawing of an embodiment of the invention, prepared from a transmission electron microscope photograph and described in the patent application from page 13, line 17 through page 14, line 17. This figure further shows the orderly microstructure of a thin film magnet according to the invention, although no corresponding transmission electron microscope image was incorporated in the patent application.

Claim 1 cannot be obvious in view of Araki for the simple reason that Araki does not describe and never suggests the thin film magnet with the orderly microstructure described in claim 1. Further, Araki neither describes nor suggests depositing a thin film magnet on a substrate while maintaining the temperature of the front surface of the substrate within the very narrow temperature range specified in claim 1. Therefore, the disclosure of Araki would never suggest preparation, even by accident, of the claimed thin film magnet.

What is described in Araki as a physical deposition process for depositing a thin film magnet employs a plasma. A plasma is a complex high temperature environment of ionized and un-ionized particles rapidly moving in many directions. When a substrate is exposed to a plasma in the course of depositing a film on the substrate, as in Araki, although the temperature at the rear side of the substrate may be relatively constant, the temperature of the front side of the substrate, which is exposed to the plasma, substantially fluctuates. This temperature fluctuation in the conventional process, for example in Araki, is illustrated in Figure 18 of the patent application. That figure shows that the temperature of the front side of the substrate varies significantly, and not even monotonically. Rather, that temperature

variation is sinusoidally modulated in amplitude, with the average temperature of the front surface gradually increasing over time. By contrast, as shown by the broken line in that Figure 18, in the process according to the invention, the temperature of the front surface of the substrate is maintained essentially constant. As a result of the temperature modulation in the prior art process, as described in the patent application at page 18, the thin film magnet structure produced is the structure illustrated in Figure 3 of the patent application. As already described, in that structure polycrystalline regions, i.e., regions with multiple grains of monocrystalline structure, are separated from each other by an amorphous phase. This microstructure is not the microstructure of the thin film magnet claimed.

Since Araki never describes controlling the temperature of the front surface of the substrate during deposition of the thin film magnet, the microstructure of the claimed thin film magnet cannot be produced by nor suggested by Araki. Further, without any description of the criticality of maintaining the temperature of the front surface of the thin film magnet in a narrow range to produce a thin film magnet according to the invention, Araki cannot, by itself, suggest the invention claimed. Accordingly, *prima facie* obviousness of claims 1 and 2 has not been demonstrated. Therefore, the rejection of those claims must be reversed.

Respectfully submitted,

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Date: April 1, 2004
JAW:tps

APPENDIX

1. A thin film magnet having a microstructure composed of monocrystalline phases of the $Nd_2Fe_{14}B$ structure type, having a c-axis oriented in a film-thickness direction, and amorphous phases, wherein each $Nd_2Fe_{14}B$ type monocrystalline phase is isolated from other monocrystalline phases by the amorphous phase, and said thin film magnet is formed by forming an $R_xM_{1-x-y}B_y$ thin film (where R is at least one element selected from the group consisting of Nd, Pr, Tb, Ho, and Dy, and M is at least one element selected from the group consisting of Fe, Co, and Ni, and $0.11 \leq x \leq 0.15$, and $0.12 \leq y \leq 0.20$) on a front side of a substrate by a physical deposition method while controlling temperature of the front side of the substrate within a range of $\pm 2°C$.

2. The thin film magnet according to Claim 1, wherein the amorphous phases are ferromagnetic.